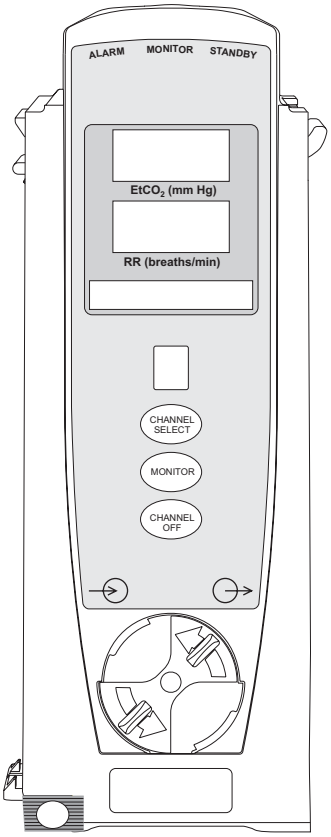
Technical Service Manual

Alaris® $EtCO_2$ Module, 8300 Series

Supports: Guardrails® Suite (v7 or later)

January 2006



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1 GENERAL INFORMATION

Chapter 1 — GENERAL INFORMATION

CAUTION

To avoid damaging the keypad, do not use sharp objects (pens, pencils, etc.) to activate switches.

CAUTION

Any attempt to service this product by anyone other than an authorized Cardinal Health Service Representative while the product is under warranty may invalidate the warranty.

1.1 INTRODUCTION

This manual describes how to service the Alaris® $EtCO_2$ module 8300 Series ("$EtCO_2$ Module"). Use this manual in conjunction with the following Alaris® System documents and software:

- Alaris® PC point-of-care unit 8000 Series ("PC Unit") / Alaris® Pump module 8100 Series ("Pump Module") Technical Service Manual
- The PC Unit section of the Alaris® System Directions for Use (DFU)
- The $EtCO_2$ Module section of the Alaris® System DFU
- Maintenance Software User Manual (version 7 or later)

This manual is intended for personnel experienced in analysis, troubleshooting, and repair of analog/digital microprocessor-based medical equipment.

The $EtCO_2$ Module is a capnograph indicated for continuous, noninvasive monitoring of end tidal carbon dioxide ($EtCO_2$), fractional inspired carbon dioxide ($FiCO_2$) and respiratory rate (RR). The $EtCO_2$ Module and disposables are indicated for use with intubated and nonintubated adult, pediatric, and neonatal patients. It is not intended for direct connection to ventilator or breathing systems. Only one (1) $EtCO_2$ Module can be connected to the Alaris® System.

The $EtCO_2$ Module is used with Oridion's patented Microstream® Disposables/circuits for sidestream capnography.

1.2 PRECAUTION DEFINITIONS

Refer to the Alaris® System DFU.

1.3 SPECIFICATIONS

Refer to the product-specific ($EtCO_2$ Module) section of the Alaris® System DFU.

1.4 OPERATING FEATURES, CONTROLS AND INDICATORS

Refer to the product-specific section of the Alaris® System DFU.

1.5 ALARMS, ERRORS, MESSAGES

The scrolling Channel Message Display bar shows alarms and other messages. Refer to the product-specific ($EtCO_2$ Module) section of the Alaris® System DFU for detailed information.

1.5.1 Silencing Alarms

All alarms can be temporarily silenced by pressing the **SILENCE** key on the PC Unit.

WARNING

If an alarm condition on the $EtCO_2$ Module occurs while the audio alarm is silenced, the only alarm indications will be visual displays and symbols related to the alarm condition.

2 CHECKOUT & CONFIGURATION

Chapter 2 — CHECKOUT AND CONFIGURATION

CAUTION

Should an instrument be jarred severely or dropped, remove it from use immediately. It should be thoroughly tested and inspected by qualified service personnel to ensure proper function prior to reuse.

2.1 INTRODUCTION

This chapter describes the initial setup and configuration for the $EtCO_2$ Module.

2.2 NEW INSTRUMENT CHECKOUT

Refer to the $EtCO_2$ Module Directions for Use (DFU) for instructions regarding unpacking and setting up the instrument for first time use.

When powering up the instrument, verify the instrument beeps and all display LED segments flash. This confirms that the instrument has performed its self test and is operating correctly. During operation, the instrument continually performs a self test, and will alarm and display a message if it detects an internal malfunction.

Contact Cardinal Health authorized service personnel if the instrument has physical damage, fails to satisfactorily pass the startup sequence, fails a self test, or continues to alarm.

For new instrument checkout, the minimum checks (described in the Maintenance Software User Manual) are:

- Regular Inspection
- Functional Tests

2.3 CONFIGURATION OPTIONS AND DEFAULTS

NOTES:

- Changes to the factory default values are retained after a power cycle.
- If **Factory Default** is **Yes**, then all the configuration settings are set to their factory default.
- If **Factory Default** is **No**, then one or more of the configuration settings has been changed. If desired, **Factory Default** can be selected and set to **Yes**, which will set all configuration settings to their factory default.
- With the Profiles feature enabled, the settings are configured independently for each profile. A hospital-defined, best-practice data set must be uploaded to enable the Profiles feature. Date and Time is a system setting and is the same in all profiles.

System Settings: Refer to the PC Unit section of the Alaris® System DFU for information on system settings (including alarm audio profile, battery meter enable/disable, clock setup, key click audio enable, tamper resist enable/disable).

$EtCO_2$ Module Settings: Refer to the product-specific ($EtCO_2$ Module) section of the Alaris® System DFU for information on $EtCO_2$ Module settings (including limit mode, high and low respiratory rate alarm limit, high and low $EtCO_2$ alarm limit, no breath alarm setting, and high $FiCO_2$ alarm limit).

NOTES:

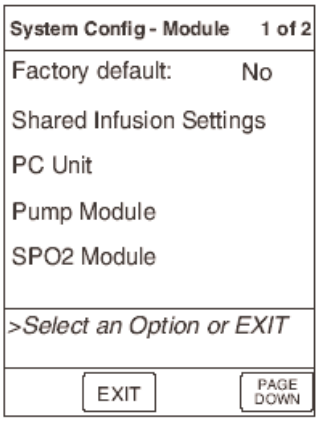
- Pressing the **EXIT** soft key while in a **System Config - Module** screen immediately powers the system down, with no “Powering Down” display.
- Pressing the **EXIT** soft key while in a **System Config - $EtCO_2$** screen returns the display to the main **System Config - Module** screen.
- Pressing the **CONFIRM** soft key while in a System Configuration option screen:
  - ♦ accepts existing setting or setting change
  - ♦ displays next option setting screen (if applicable) or returns display to **System Config - $EtCO_2$** screen
- Pressing the Point-of-Care Unit’s **CANCEL** key while in a System Configuration option screen:
  - ♦ leaves setting unchanged
  - ♦ returns display to **System Config - $EtCO_2$** screen

2.4 CONFIGURATION SETUP

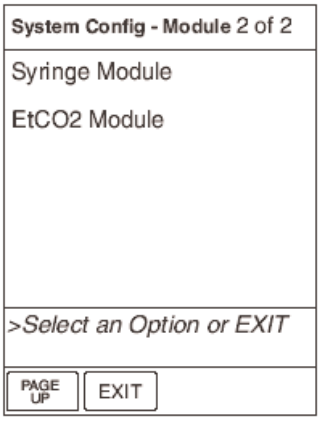
To access System Configuration options:

> **NOTE:** Refer to $EtCO_2$ Module DFU for alarm settings. If profiles are enabled, those settings are set by the profile.

1. Hold **OPTIONS** key at power up.



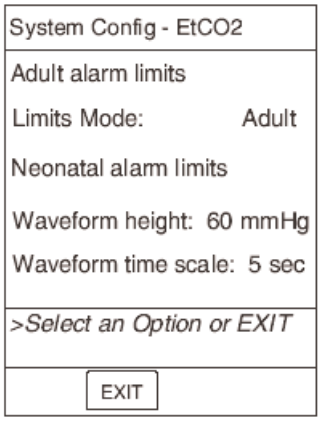
2. Press **PAGE DOWN** soft key.



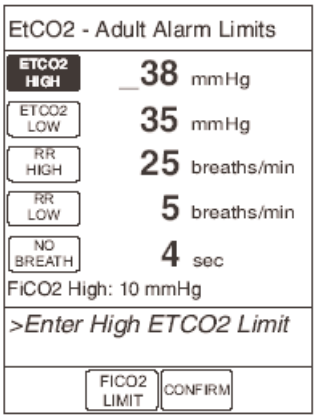
3. Press **$EtCO_2$ Module** soft key.

2.4.1 Alarm Limits

> **NOTE:** The following examples show adult alarm limits for illustration. Follow the same steps for neonatal alarm limits.



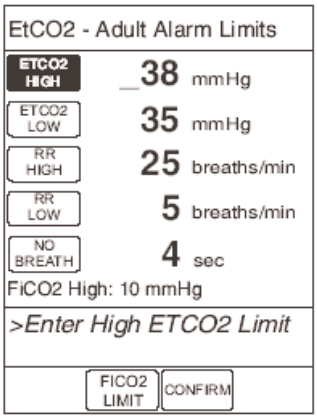
1. From the **System Config - $EtCO_2$** display, press the **Adult alarm limits** or **Neonatal alarm limits** soft key.



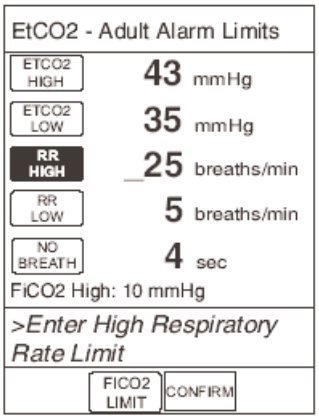
2. To change an alarm limit, press the soft key next to that parameter. The selected parameter is highlighted.

2.4 CONFIGURATION SETUP (Continued)

2.4.1 Alarm Limits (Continued)



3. Enter a numeric value for the selected alarm limit. Use the numeric keypad or the up or down arrow keys to enter the value. If a valid value appears in the field for three seconds, the display shows the prompt > *Press **CONFIRM** to Apply Changes*.



4. Press **ENTER** on the Point-of-Care Unit to confirm the value. Once you press **ENTER**, the next limit is highlighted and the display prompts for an entry.

5. To change another alarm limit, press the soft key for that parameter and enter a new value.

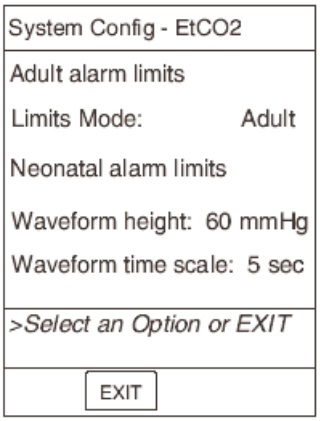
6. Once all changes are complete, press the **CONFIRM** soft key.

2.4.2 Limit Mode

NOTES:

- The following examples show adult alarm limits for illustration. Follow the same steps for neonatal alarm limits.
- If a profile is in use for programming, you cannot change the Limit Mode.

1. To change the Limit Mode, toggle its value from the **System Config - $EtCO_2$** display, or use the **Limits mode** soft key.



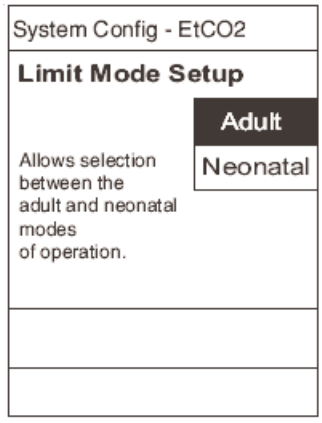
Press the **Limits Mode** soft key to toggle between the two acceptable values

2. *To toggle the value*: From the **System Config - $EtCO_2$** display, press the soft key for the Limit Mode selection. Every key press toggles the value between Adult and Neonatal.

3. *To use the soft key*: From the **System Config - $EtCO_2$** display, press the **Limits Mode** soft key.

2.4 CONFIGURATION SETUP (Continued)

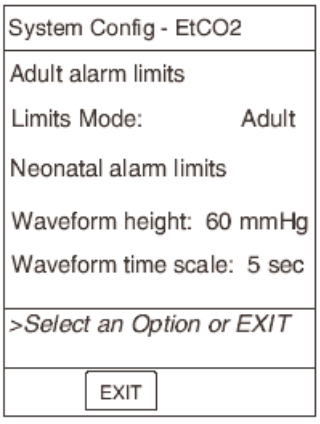
2.4.2 Limit Mode (Continued)



4. Press the soft key to select the **Limit Mode Setup** display, or press **CANCEL** to exit the **System Config - $EtCO_2$** display without changing the value.

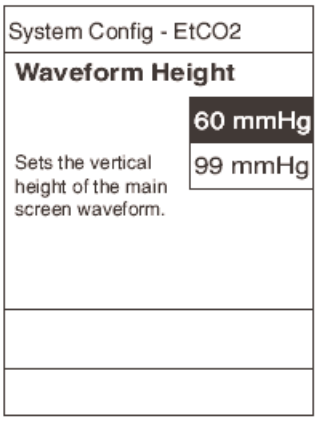
2.4.3 Waveform Height

1. To change the waveform height, you can toggle its value from the **System Config - $EtCO_2$** display, or you can use the **Waveform height** soft key.



Press the **Waveform height** soft key to toggle between the two acceptable values

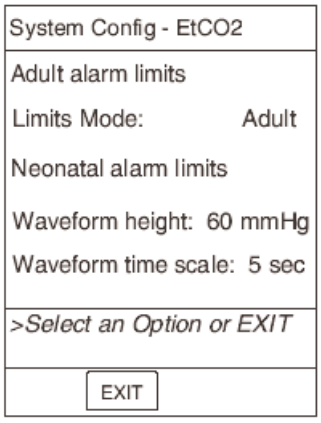
2. *To toggle the value:* From the **System Config - $EtCO_2$** display, press the soft key for the waveform height value. Every key press toggles the value between 60 and 99 mmHg.
3. *To use the soft key:* From the **System Config - $EtCO_2$** display, press the **Waveform height** soft key.



4. Press the soft key to select the waveform height, or press **CANCEL** to exit the **Waveform Height** display without changing the value.

2.4.4 Waveform Time Scale

1. To change the waveform time scale, you can toggle its value from the **System Config - $EtCO_2$** display, or you can use the **Waveform time scale** soft key.

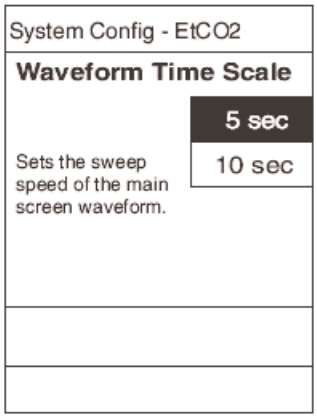


Press the **Waveform time scale** soft key to toggle between the two acceptable values

2.4 CONFIGURATION SETUP (Continued)

2.4.4 Waveform Time Scale (Continued)

2. *To toggle the value:* From the **System Config - $EtCO_2$** display, press the soft key for the **Waveform Time Scale** value. Every key press toggles the value between 5 and 10 sec.



3. *To use the soft key:* From the **System Config - $EtCO_2$** display, press the **Waveform time scale** soft key.
4. Press the soft key to select the waveform height, or press **CANCEL** to exit the Waveform time scale display without changing the value.

Table 2-1. Record of Configured Instruments

	#1	#2	#3	#4
Instrument ID/Serial #				
$EtCO_2$ Alarm Limit, High				
$EtCO_2$ Alarm Limit, Low				
$FiCO_2$ Alarm Limit, High				
Limit Mode				
No Breath Alarm				
Respiratory Rate Alarm Limit, High				
Respiratory Rate Alarm Limit, Low				
Waveform Height				
Waveform Time Scale				

NOTE: If profiles are enabled, alarm limits are set by the profile.

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3 PREVENTIVE MAINTENANCE

Chapter 3 — PREVENTIVE MAINTENANCE

WARNING

Failure to perform regular and preventive maintenance inspections may result in improper instrument operation.

3.1 INTRODUCTION

Perform regular and preventive maintenance inspections to ensure that the $EtCO_2$ Module remains in good operating condition:

- Perform regular inspections before each use.
- Perform preventive maintenance inspections annually.

These requirements and guidelines are intended to complement the intent of Joint Commission on Accreditation of Healthcare Organizations (JCAHO) requirements.

3.2 REGULAR AND PREVENTIVE MAINTENANCE INSPECTIONS, CALIBRATION

Use the Maintenance Software (version 7 or later) to perform calibration and preventive maintenance.

Contact Cardinal Health Technical Support if you need help obtaining or using the Maintenance Software.

3.3 CLEANING

Refer to the PC Unit section of the Alaris® System DFU.

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Chapter 4 — PRINCIPLES OF OPERATION

4.1 INTRODUCTION

This chapter describes the principles of operation for the $EtCO_2$ Module and its major subsystems.

Refer to the PC Unit/Pump Module Technical Service Manual for Point-of-Care Unit information.

4.2 GENERAL INFORMATION

The $EtCO_2$ Module uses Oridion's patented Microstream® non-dispersive infrared (NDIR) spectroscopy to continuously measure the amount of CO_2 during every breath, the amount of CO_2 present at the end of exhalation ($EtCO_2$) and during inhalation ($FiCO_2$), and the Respiratory Rate. The $EtCO_2$ Module is a side stream capnograph.

The Microstream® Disposables deliver a sample of the inhaled and exhaled gases from the ventilator disposable or directly from the patient (via an oral/nasal cannula) into the monitor for CO_2 measurement. Moisture and patient secretions are extracted from the sample by the Microstream® inline filter while maintaining the shape of the CO_2 waveform.

The 50 mL/min sampling flow rate reduces liquid and secretion accumulation, decreasing the risk of obstruction in the sample pathway in humid ICU environments. The small sample size required by Microstream® eliminates the need for water traps and prevents excess fluid accumulation.

The $EtCO_2$ Module draws a gas sample through a microsample cell (15 microliters). This extremely small volume is quickly flushed, allowing for a rise time of

4.2 GENERAL INFORMATION (Continued)

approximately 190 ms and accurate CO_2 readings, even at high respiration rates.

The Microbeam IR source illuminates the microsample cell and the reference channel. This proprietary IR light source generates only the specific wavelengths characteristic of the CO_2 absorption spectrum. The IR light that passes through the microsample cell and the IR light that passes through the reference channel are measured by IR detectors.

The microcomputer in the $EtCO_2$ Module calculates the CO_2 concentration by comparing the signals from both channels.

No operator intervention is required for routine moisture or condensate.

All Microstream® Disposables contain an inline hydrophobic filter to extract condensate and/or patient secretions while maintaining measurement and waveform integrity. For humid conditions within the operating parameters of the $EtCO_2$ Module and Microstream® Disposables, humidity has no quantitative effect on the CO_2 concentration, given the small 50 mL/min sample size rate. In high humidity environments or extended monitoring periods (24-72 hours) only Microstream® Disposables designed for those instances should be used. In the event of humidity or condensate outside the $EtCO_2$ Module's operating specifications, the $EtCO_2$ Module will present a "Remove Blocked Disposable" message.

Due to the relatively small sampling size needed for $EtCO_2$ readings, partial pressure does not affect the ability of the $EtCO_2$ Module to measure $EtCO_2$, as long as the 50 mL/min rate can be achieved.

Microstream® Disposables are single-use, disposable devices which must be changed with each use. The manufacturer's sample flow, 50 mL/minute, does not affect the disposable's life; however, humidity and specific patient conditions may shorten the effective life of the disposables. Microstream® Disposables are rated for up to 24 hour and 72 hour use, depending on the specific Microstream® Disposable.

The $EtCO_2$ Module provides readings in compliance with BTPS (body temperature, pressure, saturation) standards. There is no effect on accuracy due to cyclic pressure up to 10 kPa.

NOTE: BTPS (body temperature, pressure, saturation assumed 37°C, 47 mmHg) calculations are made according to:

$PCO_2 = FCO_2 \times (Pb - 47)$

Where:

FCO_2 is the fractional concentration of CO_2 in dry gas, and $FCO_2 = \% CO_2/100$.

Pb is the ambient pressure.

PCO_2 is the partial pressure of CO_2 at BTPS.

5 CORRECTIVE MAINTENANCE

Chapter 5 — CORRECTIVE MAINTENANCE

WARNING

Disconnect the $EtCO_2$ Module from the Alaris® System before performing maintenance. qualified personnel using proper grounding techniques should open the instrument case.

CAUTION

CMOS devices are sensitive to static electrical charges and may be damaged during repair if the repair activity is not performed in an electrostatic discharge (ESD) protected environment using approved ESD protective procedures, including personnel grounding.

NOTE: Due to product changes over time, components/ assemblies illustrated in this chapter may differ from the instrument you disassemble. If there are any questions, look for Service Bulletins related to this chapter or contact Cardinal Health Technical Support.

5.1 INTRODUCTION

This chapter describes how to disassemble and reassemble the $EtCO_2$ Module.

For more efficient repair, read the “Principles of Operation” chapter for information on the mechanical and electrical functions of the $EtCO_2$ Module.

The surface mount devices on the circuit boards are not field repairable. Return circuit boards to an authorized Cardinal Health Service Center for repair. Attempting circuit board repairs voids all warranties.

Whenever the $EtCO_2$ Module is repaired, perform the minimum tests required for new instrument checkout (use Maintenance Software v7 or later).

For information on replacement parts, see the “Illustrated Parts Breakdown” chapter.

Following any level of maintenance, perform the applicable tests (refer to “Level of Testing Guidelines” table).

5.2 DISASSEMBLY/REASSEMBLY

Follow these procedures in order for the most efficient disassembly of $EtCO_2$ Module subassemblies. To reassemble the $EtCO_2$ Module, reverse the disassembly steps.

CAUTION

Disconnect the $EtCO_2$ Module from the Alaris® System Before attempting disassembly.

NOTE: Perform all maintenance on an antistatic surface, preferably a grounded antistatic mat.

Before adhering gaskets and labels to the instrument, clean the surface with a cotton swab or soft cloth lightly dampened with 70% Isopropyl Alcohol.

CAUTION

To avoid the risk of electrical hazard or damage to the instrument circuitry, do not spray fluids directly onto the instrument or allow fluids to enter the instrument.

Table 5-1. Required Materials, Supplies and Tools

NOTE: Contact/source information is subject to change.

- Loctite 242 (http://www.loctite.com)
- Silicone grease, Dow Corning Molykote 33, or equivalent (http://www.dowcorning.com)
- #1 Phillips screwdriver
- #2 Phillips screwdriver
- Small diagonal cutters
- Lint-free cloth (such as, Kimwipes or lint-free tissue)

5.2 DISASSEMBLY/REASSEMBLY (Continued)

5.2.1 Latch Assembly and Feet

1. Remove two (2) screws attaching Latch Assembly to bottom of Rear Case and remove Latch Assembly components.
2. Pull two (2) Feet from underside of module.

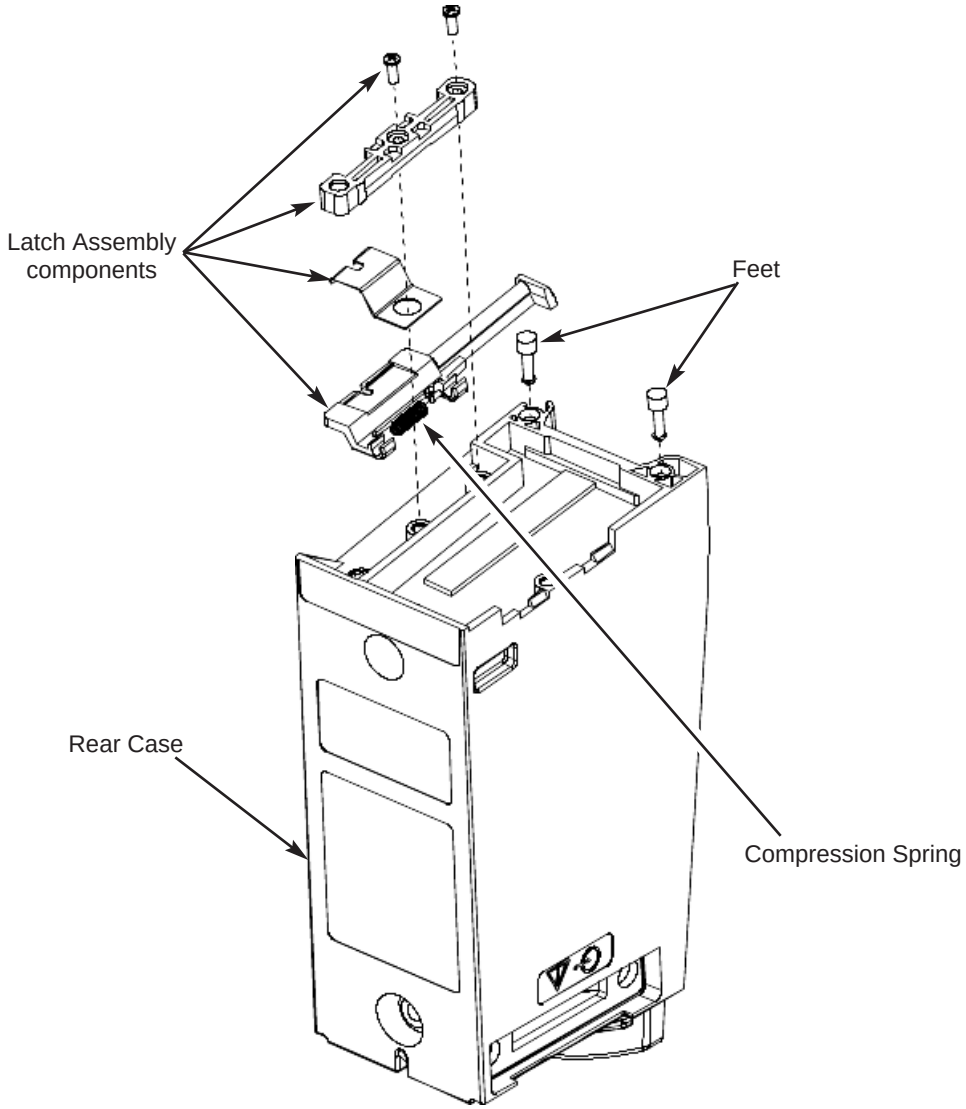
NOTE: Pay close attention to Compression Spring location and orientation to ensure proper installation during reassembly.

During Reassembly:

When reinstalling the Latch Assembly, press toward outer edge of the module and screw into position.

Apply a thin layer of Dow Corning Molykote 33 (or equivalent) silicone grease to Feet.

NOTE: The Feet press-fit into the module.



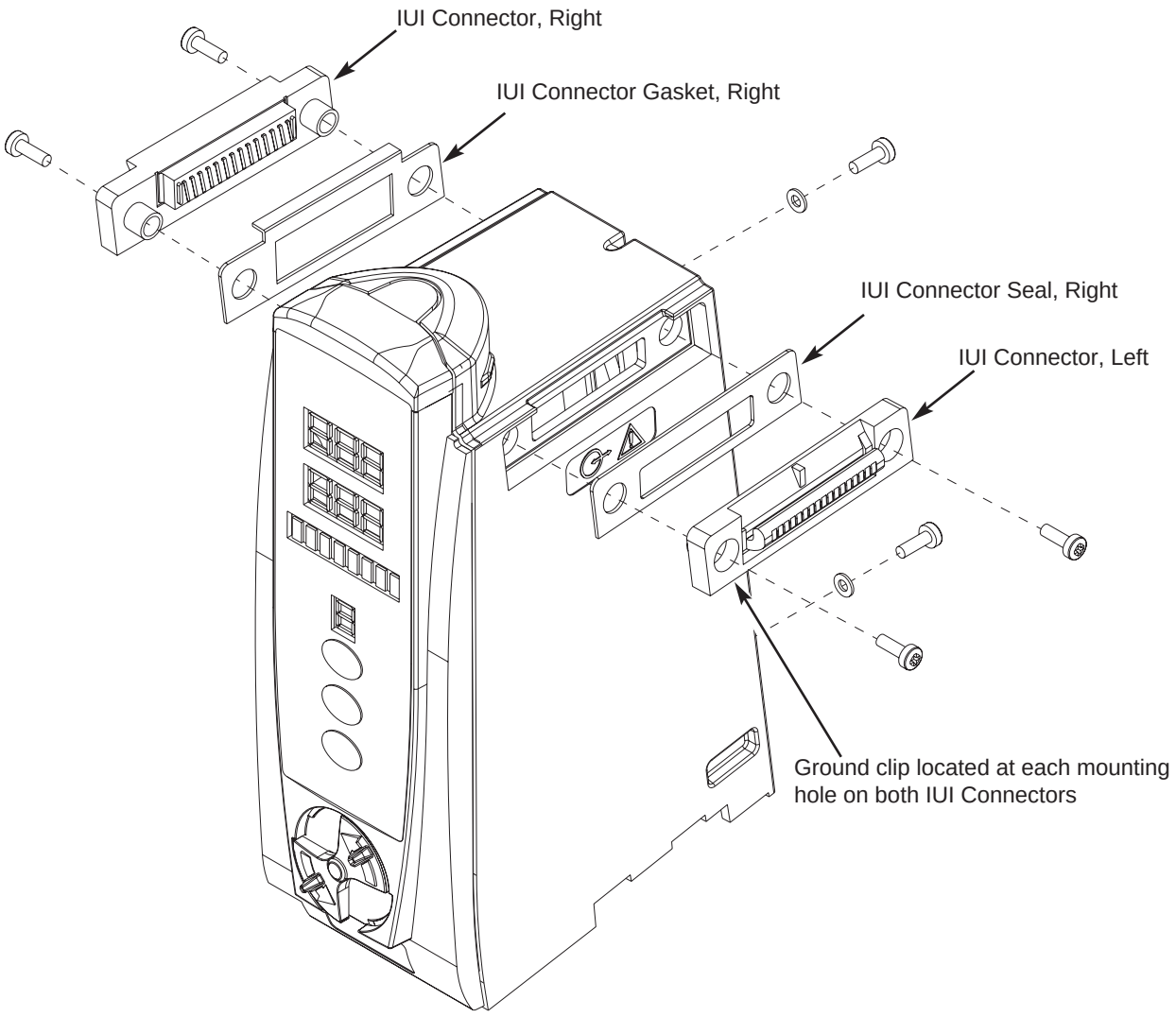
5.2 DISASSEMBLY/REASSEMBLY (Continued)

5.2.2 IUI Connectors

Remove two (2) screws attaching each IUI (left and right) to module.

During Reassembly:

- Ensure ground clips are still installed on both IUI connectors.
- To install IUI Connector Gasket, remove protective backing and adhere to IUI Connector.


IUI Connector, Right
IUI Connector Gasket, Right
IUI Connector Seal, Right
IUI Connector, Left
Ground clip located at each mounting hole on both IUI Connectors

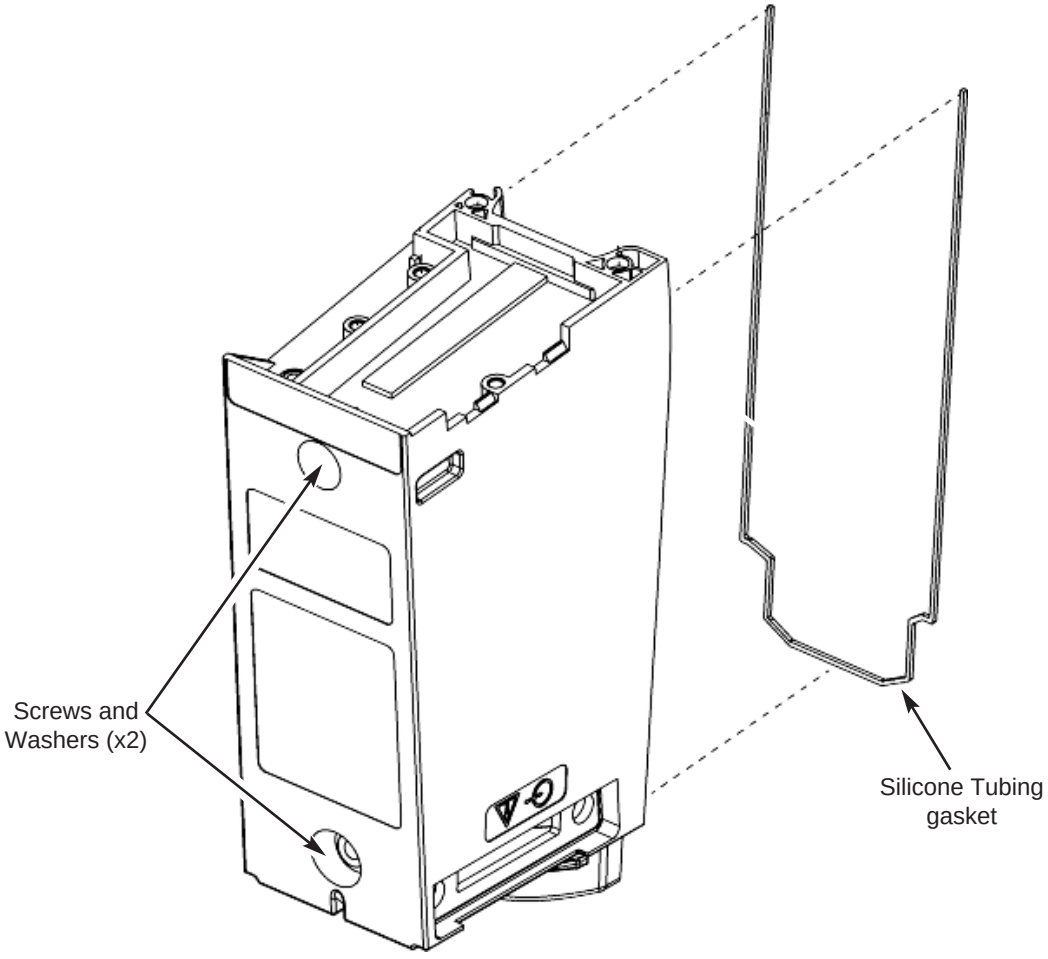
5.2 DISASSEMBLY/REASSEMBLY (Continued)

5.2.3 Rear Case

1. Remove two (2) screws (and associated washers) attaching Rear Case to chassis assembly.
2. Pull Rear Case away from chassis assembly.

During Reassembly:

Ensure that Silicone Tubing gasket in Rear Case is in place and undamaged.



Rear Case Assembly

5.2 DISASSEMBLY/REASSEMBLY (Continued)

5.2.4 Frame Assembly

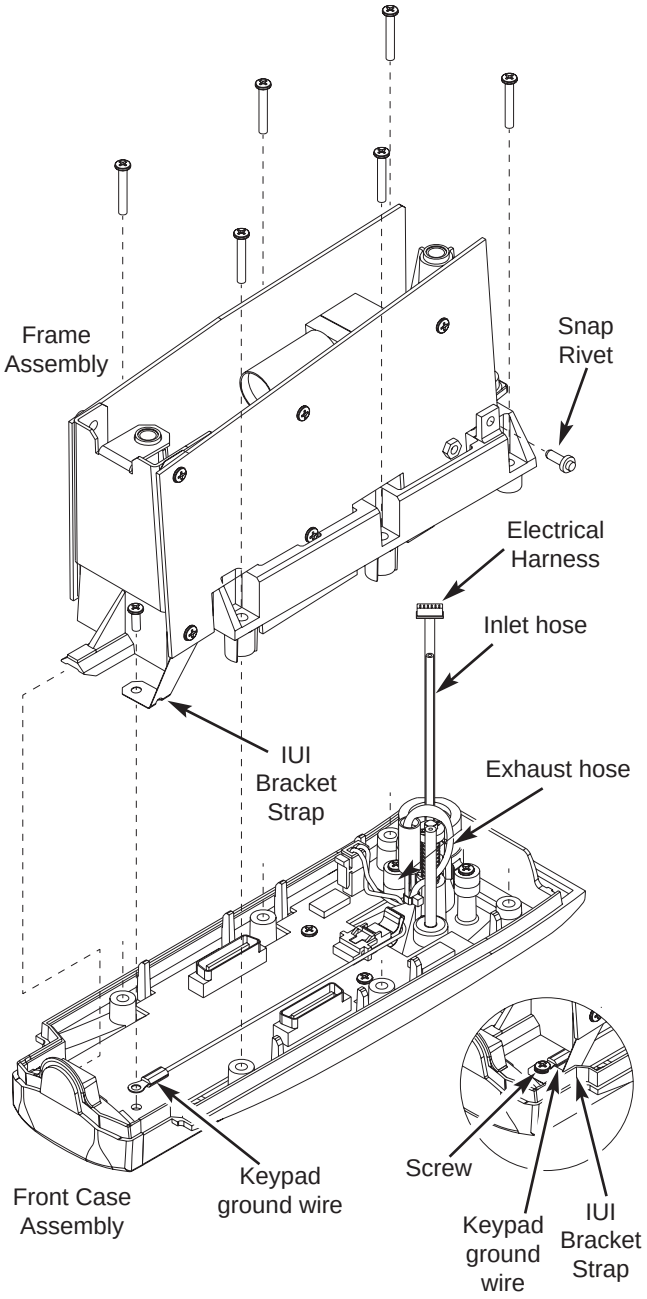
CAUTION

When using cutters to remove snap rivet, take care not to cut the rivet.

1. Remove six (6) screws attaching Frame Assembly to Front Case.
2. Use small diagonal cutters to remove upper snap rivet attaching Power Board to Frame Assembly.
2. Remove the IUI Bracket Strap from the Display Board.
3. Carefully remove Frame Assembly from Front Case Assembly, then place the Frame Assembly to the left of the Front Case, taking care not to damage hoses and wires.
4. Disconnect electrical harness from Oridion Module.
5. Disconnect the inlet and exhaust hoses on the Oridion Module.

During Reassembly:

- Fit the top flange of the Frame Assembly into the square slot on the Status Indicator Lens.
- Fit the connectors on the Power Board and Logic Board into the two (2) connectors on the Display Board.
- Ensure that the harness and hoses are fully connected, and route them so they are not pinched during reinstallation.
- Slide the IUI Bracket Strap under the keypad ground wire on the Display Board.



5.2 DISASSEMBLY/REASSEMBLY (Continued)

5.2.5 Logic Board

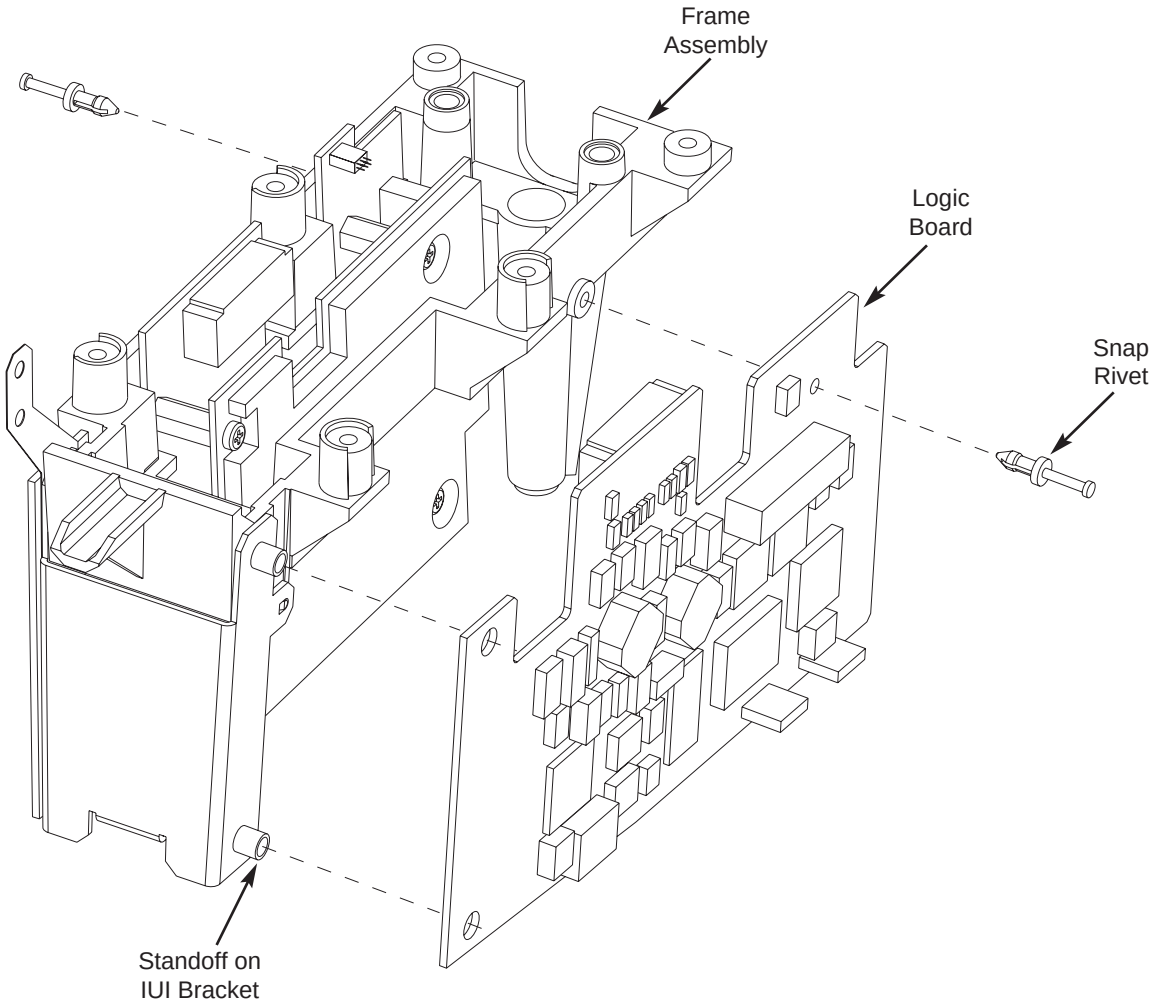
CAUTION

When using cutters to remove snap rivet, take care not to cut the rivet.

1. Use small diagonal cutters to remove snap rivet attaching Logic Board to Frame Assembly.
2. Remove Logic Board from Frame Assembly.

During Reassembly:

- Seat the holes in the Logic Board over the standoffs on the IUI Bracket.
- Reinstall the snap rivet and its locking pin to secure the Logic Board to the Frame Assembly.



5.2 DISASSEMBLY/REASSEMBLY (Continued)

5.2.6 Power Board/Oridion Module

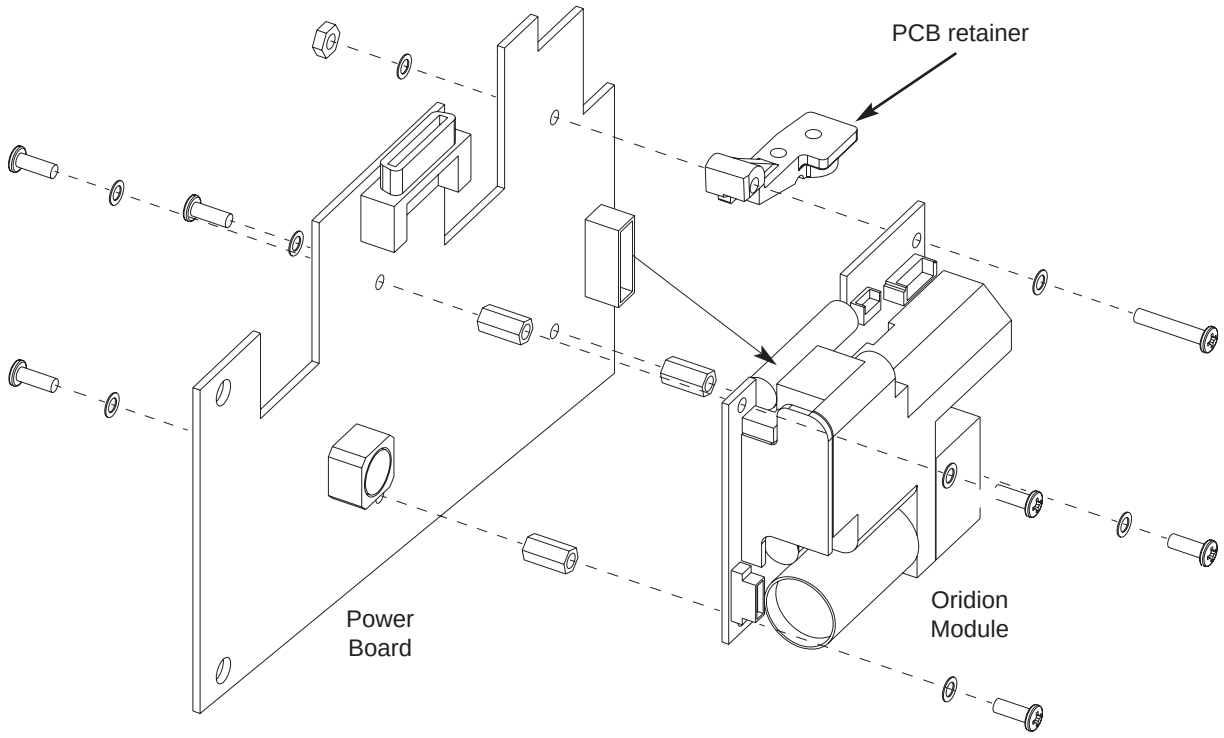
CAUTION

When using cutters to remove snap rivet, take care not to cut the rivet.

1. Use small diagonal cutters to remove upper (if installed) and lower snap rivet(s) attaching Power Board to Frame Assembly. If installed, remove IUI Bracket Strap.
2. Remove screw holding PCB retainer to Frame Assembly.
3. Remove Power Board from Frame Assembly.
4. Disconnect electrical harness between Power Board and Oridion Module.
5. Separate Power Board and Oridion Module:
   - Remove three (3) screws from underside of Power Board.
   - Remove screw and nut attaching PCB retainer to Power Board.

During Reassembly:

- Ensure that Oridion Module and PCB retainer are positioned correctly over the Power Board before reinstalling.
- Reinstall the IUI Bracket Strap and snap rivets to secure the Power Board to the Frame Assembly.



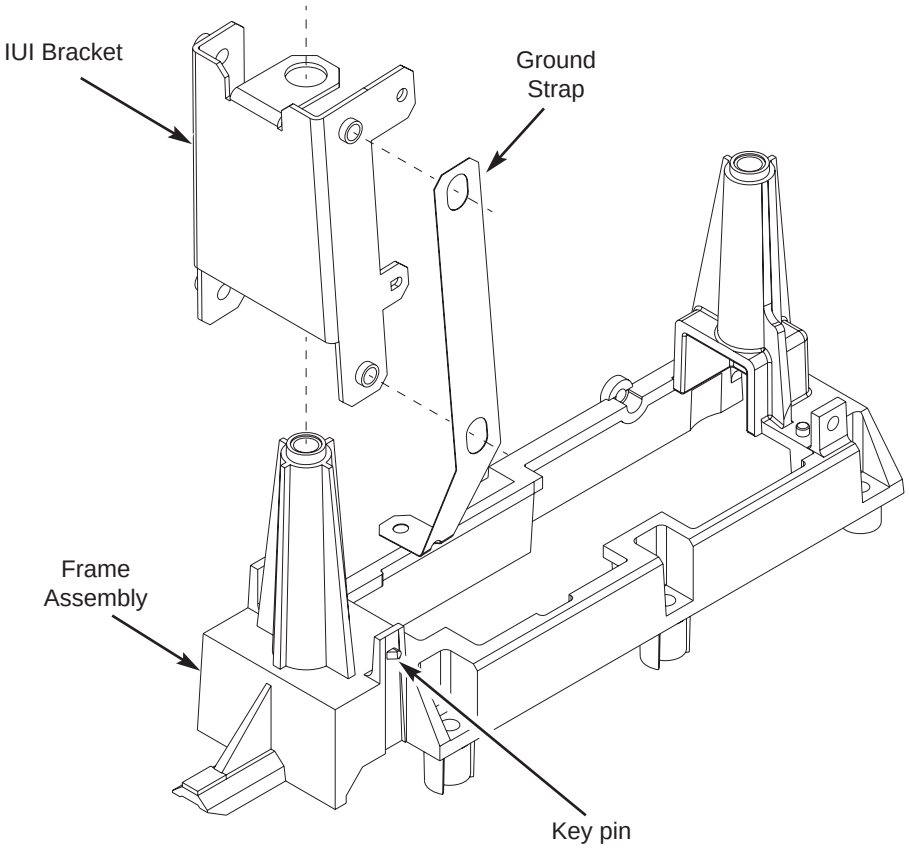
5.2 DISASSEMBLY/REASSEMBLY (Continued)

5.2.7 IUI Bracket

Flex IUI Bracket away from key pins and remove bracket and Ground Strap from Frame Assembly.

During Reassembly:

Position IUI Bracket over key pins on Frame Assembly



5.2 DISASSEMBLY/REASSEMBLY (Continued)

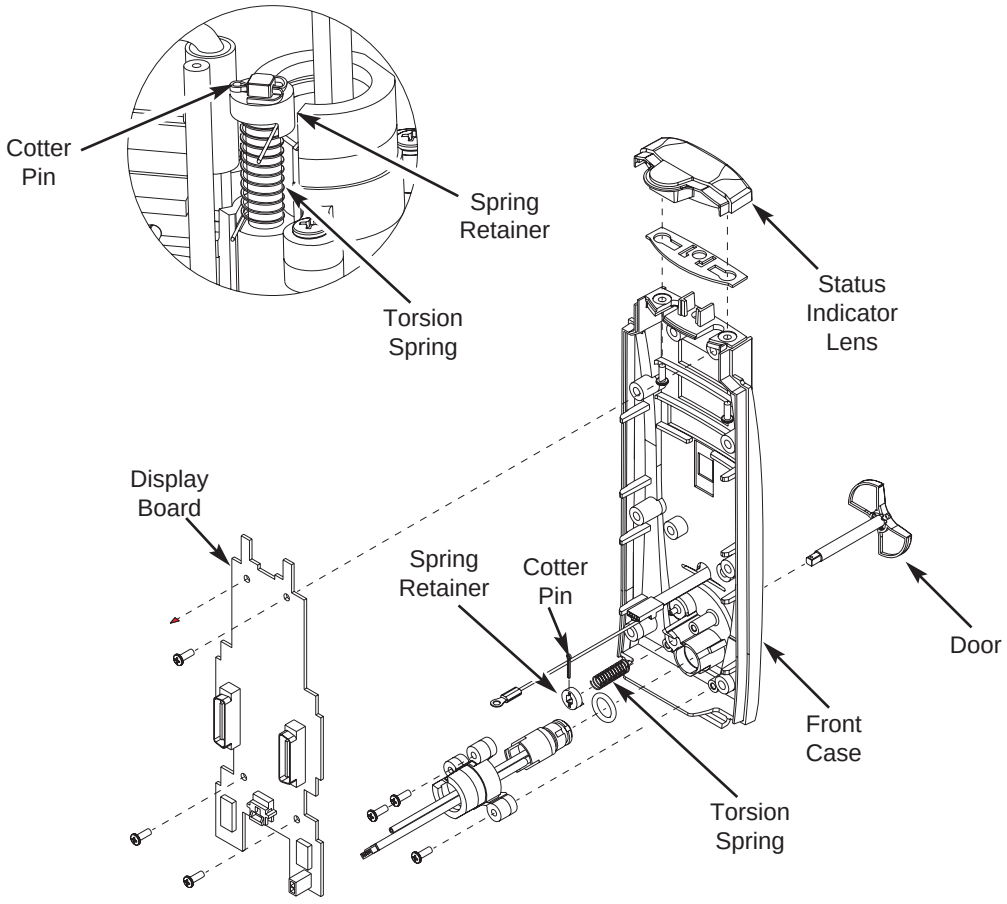
5.2.8 Gas Inlet/Outlet Door

> **NOTE:** To hold Torsion Spring in place during removal, hold Spring Retainer firmly when removing Cotter Pin.

1. From inside Front Case Assembly, straighten Cotter Pin legs and from Spring Retainer.
2. Slowly lift Spring Retainer to relieve compression on Torsion Spring.
3. Remove Torsion Spring.
4. Remove Door from Front Case Assembly.

During Reassembly:

1. Place Torsion Spring on Door shaft with long end facing up.
2. Align Spring Retainer with shaft, push Torsion Spring down, insert Cotter Pin through Spring Retainer, then wind Cotter Pin legs around Door shaft to secure.
3. Wind Torsion Spring 1/4-turn and secure long end of Spring under Spring Retainer.



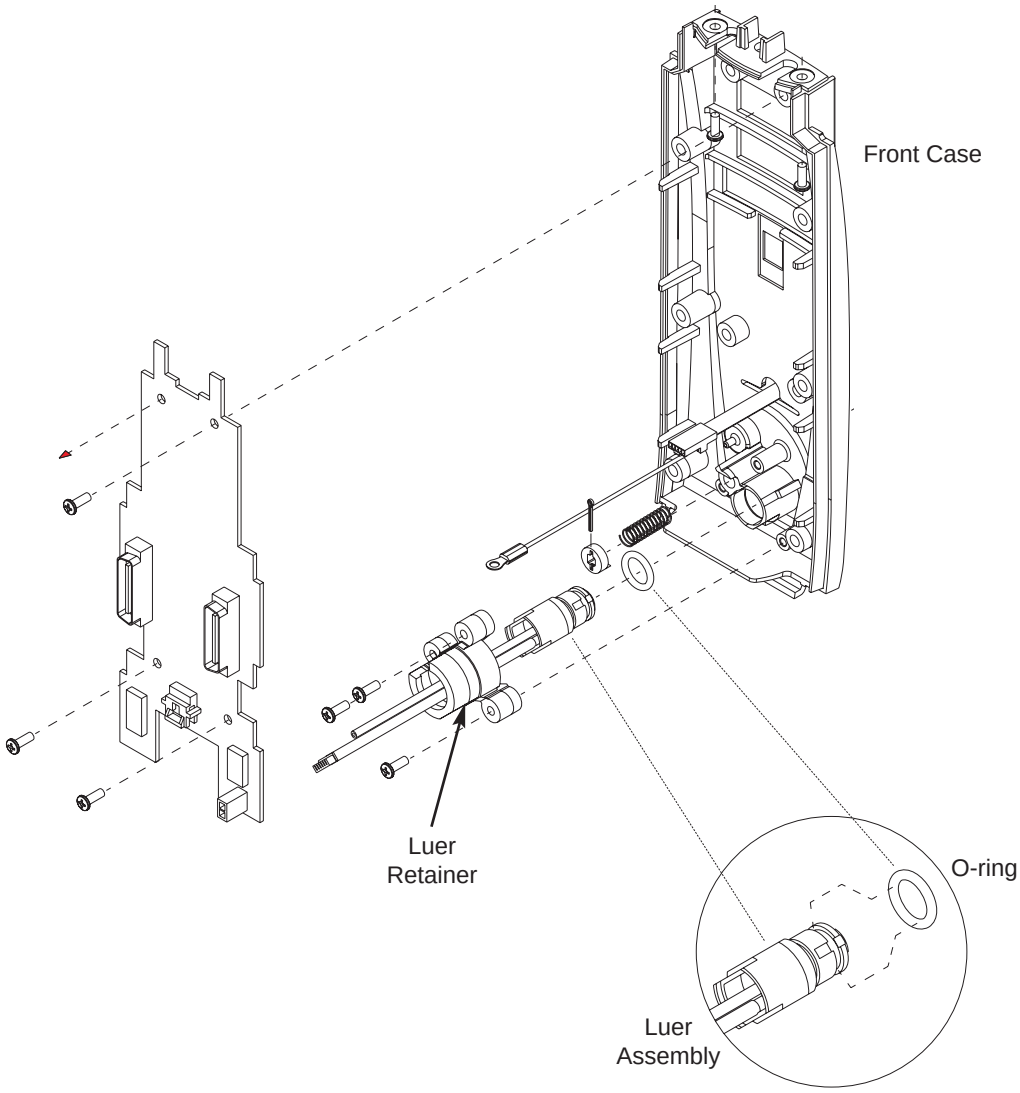
5.2 DISASSEMBLY/REASSEMBLY (Continued)

5.2.9 Luer Assembly

1. Remove three (3) screws attaching Luer Retainer to Front Case.
2. Remove Luer Retainer from Front Case.
3. Separate Luer Assembly from Luer Retainer.

During Reassembly:

- Ensure that O-ring is correctly positioned on Luer Assembly, then apply a small bead of water around the O-ring: this helps O-ring to remain in place when installing Luer Assembly into Front Case.
- Position Luer Retainer over screw holes in Front Case, then install screws to secure.



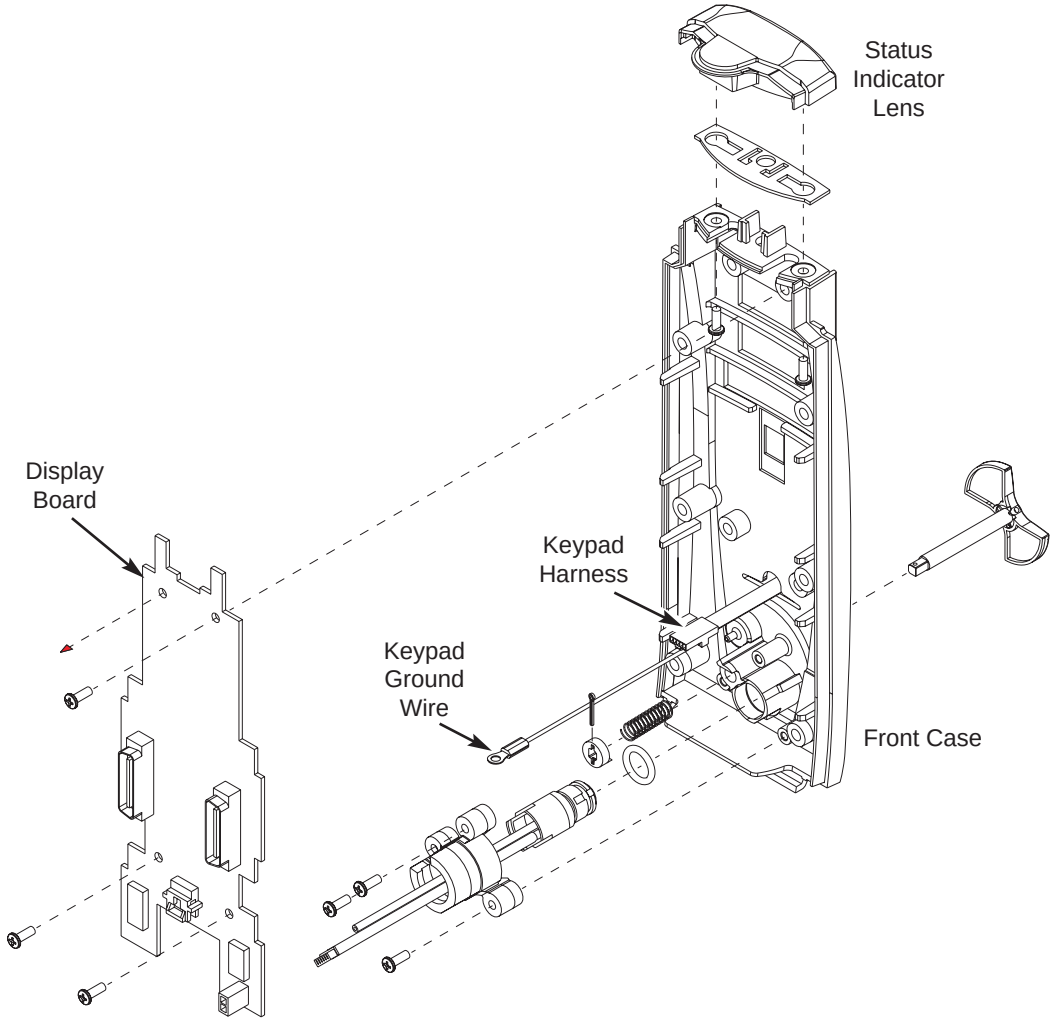
5.2 DISASSEMBLY/REASSEMBLY (Continued)

5.2.10 Display Board

1. Remove screw attaching ground wire to Display Board.
2. Cut cable tie, then disconnect Keypad Harness and Backlight harnesses from Display Board.
3. Remove three (3) screws attaching Display Board to Front Case.
4. Remove Display Board from Front Case

During Reassembly:

- When reinstalling Display Board, slide LEDs under Status Indicator Lens.
- Reinstall screws attaching Display Board to Front Case.
- Reinstall Keypad and Backlight Harness, then replace the cable tie.
- Reinstall the keypad ground wire.



5.2 DISASSEMBLY/REASSEMBLY (Continued)

5.2.11 Status Indicator Lens

1. Remove two (2) screws attaching Status Indicator Lens and Gasket to Front Case.
2. Remove Status Indicator Lens.

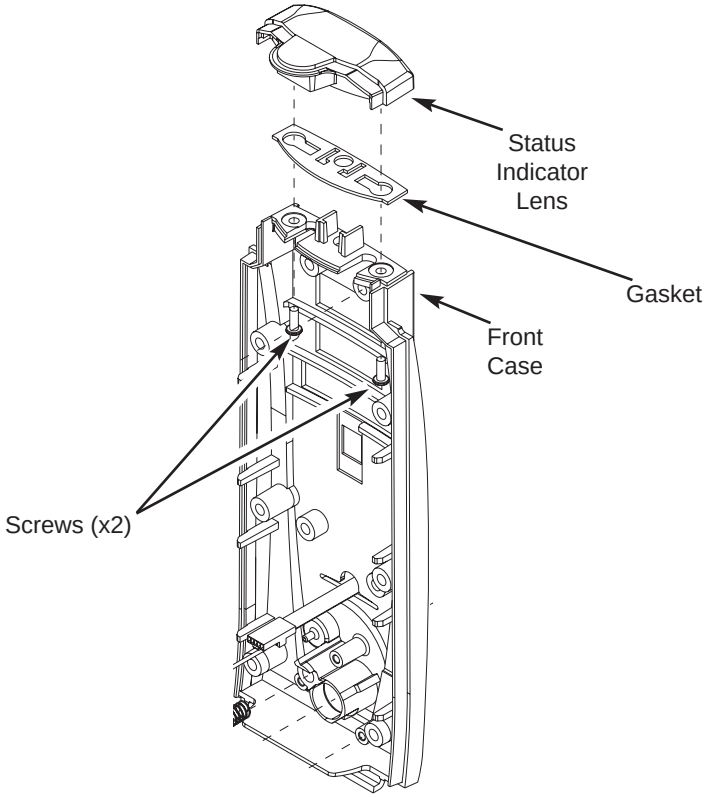


Table 5-2. Torque Values

Functional Application	Item Description	Torque Value
FINAL ASSEMBLY		
IUI Connectors	6-32 x 7/16	12 in/lb
Latch Assembly	4-40 x 3/8 Torx Security	6 in/lb
Rear Case - Internal Frame	6-32 x 7/16	12 in/lb
FRONT CASE ASSEMBLY		
Display Board	4-40 x 5/16	6 in/lb
Internal Frame - Front Case	4-40 x 3/4	6 in/lb
IUI Bracket Strap and Ground Wire	4-40 x 5/16	6 in/lb
Status Indicator Lens	4-20 x 5/16	6 in/lb
Luer Mount	4-20 x 5/16	6 in/lb
Power Board/Oridion Module	4-40 x 1/8	6 in/lb

Table 5-3. Level of Testing Guidelines

Tests to Perform ● = Required **X** = If verification fails. Blank = Not Applicable **Repair/Replacement of: ↓**	Alarm Test	Channel ID/IUI Connector Test	CO_2 Sensor Calibration	CO_2 Sensor Verification	Keypad Test	Simultaneous Display Test	Visual/Instrument Inspection	Leak Down Test
Display Board	●	●	●	●		●	●	●
Frame Assembly	●	●	●	●	●	●	●	●
Front Case	●	●	●	●	●	●	●	●
Gas Inlet/Outlet Door	●	●	●	●	●	●	●	●
IUI Bracket	●	●	**X**	●	●	●	●	●
IUI Connectors	●	●					●	
Latch Assembly and Feet							●	
Logic Board	●	●	●	●	●	●	●	
Luer Assembly	●	●	●	●	●	●	●	●
Power Board/Oridion Module	●		●	●			●	●
Rear Case	●						●	
Status Indicator Lens	●	●	●	●	●	●	●	●
Miscellaneous: ↓								
Instrument dropped	●	●	**X**	●	●	●	●	●
Instrument software flashed							●	
New instrument checkout	●	●	**X**	●	●	●	●	●
No fault found (instrument not opened)							●	
No fault found (instrument opened)	●	●	●	●	●	●	●	●

NOTES:

- Use the Maintenance Software to perform testing and calibration.
- After performing any calibration procedure, always perform the associated verification test.

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6 TROUBLESHOOTING

Chapter 6 — TROUBLESHOOTING

WARNING

Use extreme caution in servicing the instrument when connected to AC power. Hazardous voltages are present when AC power is connected, regardless of the setting of the power switch.

6.1 INTRODUCTION

This chapter describes possible technical problems and operating errors that may occur while using the $EtCO_2$ Module. Refer to this chapter before attempting to service the $EtCO_2$ Module.

Refer to the PC Unit / Pump Module Technical Service Manual for information on viewing the Malfunction Log.

Table 6-1. Technical Troubleshooting Guide

Follow the steps in the order they are listed until the problem/fault is corrected. Before making a final diagnosis, visually inspect the instrument for damage and pay particular attention to the power cord and plug. Following repair/replacement, use Maintenance Software to perform the required tests (see Chapter 5). Perform the Ground Current Leakage and Ground Leakage tests described in the PC Unit / Pump Module Technical Service Manual to verify that the system is electrically safe.

Problem	Remedy
Display Problem	1. Check cable connections. 2. Replace Display. 3. Replace Logic Board. 4. Return to factory.
Intermittent Operation	1. Check connections to Logic Board. 2. Replace Logic Board. 3. Return to factory.
Instrument Malfunction	1. Turn instrument off and back on to see if problem clears. 2. Refer to alarm history, malfunction codes (Table 6-2), and subsystem codes (see PC Unit / Pump Module (8000/8100 Series) Technical Service Manual).
Key Stuck Alarm	1. Turn instrument off and back on to see if problem clears. 2. Replace Keypad Assembly. 3. Replace Logic Board. 4. Return to factory.

Table 6-2. Malfunction Codes

Refer to the PC Unit / Pump Module Technical Service Manual for information on viewing the Malfunction Log.

Malfunction Code	Subsystem	Explanation	Remedy
500	Main Logic Board	See NOTE	See NOTE
510	Keypad Decoder	See NOTE	See NOTE
511	Keypad Decoder Comm Error	See NOTE	See NOTE
530	Keypad Error	See NOTE	See NOTE
550	IUI Error	See NOTE	See NOTE
560	Power Supply Board Error	See NOTE	See NOTE
570	$EtCO_2$ Board Error	See NOTE	See NOTE
571	$EtCO_2$ Board Comm Error	See NOTE	See NOTE
6200	$EtCO_2$ Board Error	Failed continuous built-in tests.	Cycle power. If error repeats, replace $EtCO_2$ Board.
6210	$EtCO_2$ Board Error	Communications error.	Cycle power. If error repeats, replace $EtCO_2$ Board.
6220	$EtCO_2$ Board Error	Configuration error.	Cycle power. If error repeats, replace $EtCO_2$ Board.
6230	$EtCO_2$ Board Error	Received value out of range.	Replace Microstream Disposable device. If error repeats, replace $EtCO_2$ Board.
6240	$EtCO_2$ Board Error	Missing sensor status.	Replace Microstream Disposable device. If error repeats, replace $EtCO_2$ Board.

NOTE: Refer to Troubleshooting information in the PC Unit / Pump Module Technical Service Manual for more detailed descriptions of codes.

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7 ILLUSTRATED PARTS BREAKDOWN

Chapter 7 — ILLUSTRATED PARTS BREAKDOWN

7.1 INTRODUCTION

The illustrated parts breakdown for the $EtCO_2$ Module is divided according to its major assemblies.

7.2 ILLUSTRATIONS

Use the exploded views to identify the parts of each assembly. Item numbers (the numbers in bubbles) in the illustration correspond to the item number in the parts list. A part that does not have an item number is part of a higher assembly.

NOTE: Due to product changes over time, illustrations in this chapter can differ from the instrument under service. See applicable Service Bulletins or contact Cardinal Health Technical Support for more information.

7.3 PARTS LIST

The parts lists include the following information for replaceable parts :

- *Item*: This number corresponds to the item number in the illustration.
- *Part Number*: Use this number to order the part. If a part number is not provided, that part is not available for sale, is part of a kit or higher assembly, or can only be replaced/repaired by Cardinal Health authorized service personnel.
- *Description*: Description of the part.
- *QTY*: Total number of each item used.

7.4 ORDERING PARTS

Parts can be ordered by writing or calling Cardinal Health Customer Service (refer to "General Contract Information" page at beginning of this manual). When requesting a part, provide the following information:

- Instrument name and model number; for example, $EtCO_2$ Module, Model 8300.
- Instrument software version. Refer to Alaris® System DFU for directions on how to view software version.
- Part number.
- Part description, as provided in parts list.
- For labels, specify required language.

Table 7-1. Parts List

NOTE: An “assembly” is a preassembled group of parts. A “kit” is a group of unassembled parts.

Item	Part Number	Description	QTY
15	146980-000	Gasket, Status Indicator	1
16	148140-000	Retainer, Luer	3
17	321245	O-Ring, 0.364 ID x 0.070 W 60 Duro	1
20	10013666	Front Case/Keypad Assembly (Assembled parts: Front Case, Keypad, items 15, 25, 841 qty. 2)	1
21	148128-102	Door Assembly	1
22	148130-002	Spring, Torsion	1
23	148228-000	Retainer, Spring	1
24	3211246	Pin, Cotter, 1/32 OD x 3/8 L, extended prong	1
25	146978-001	Lens, Status Indicator	1
32	144424-100	LED, Keyboard Backlight	1
35	148112-103	Board Assembly, Display	1
36	321270	Standoff, F/F, 3/16 hex x 3/8 4-40, AL	3
37	10011768	Module, Oridion	1
39	TC10003682	Board Assembly, Power Supply	1
40	142833-000	Bracket, IUI	1
45	148131-001	Frame	1
46	148227-002	Retainer, PCB	1

Table 7-1. Parts List (Continued)

Item	Part Number	Description	QTY
47	148249-100	Assembly, $EtCO_2$ Cable	1
55	TC10003899	Board Assembly, Logic	1
60	146992-001	Strap, Ground, IUI Bracket	1
70	①	Silicone Grease, Molykote Medium or equivalent	As required
75	142794-000	Foot, Rubber	2
80	320763	Tubing, Medium Silicone, 0.030 x 0.065 x 0.18	1
85	10013667	Assembly, Rear Case (Assembled parts: Rear Case, Nameplate Label, items 75, 80, 603, 620)	1
90	146456-000	Kit, Latch (Includes: Latch, Compression Spring, Leaf Spring, Support)	1
120	147077-100	Kit, Right IUI Connector (Includes: Right Seal, Right IUI Connector)	1
130	147078-100	Kit, Left IUI Connector (Includes: Left Gasket, Left IUI Connector)	1
135	10013668	Kit, Luer (Includes: Luer Assembly, item 17)	1
603	125569	Label, Serial Number, Replacement	1
620	148405-000	Label, Patent	1
630	148372-000	Label, Microstream	1
635	10010621	Label, Door	1
645	145820-000	Seal, Instrument	1
820	834031	Cable Tie, 4-in. L	1
825	300348	Screw, Machine, 4-40 x 3/4 PHH PHH	6
830	806112	Rivet, Snap, 0.125 dia., Nylon BLK	3
835	320855	Screw, 6-32 x 7/16 PHH PNH SS	6
840	320908	Washer, Flat, 0.146 ID x 0.270 OD x 0.03 THK, SS	10
841	300923	Screw, Machine, 4-40 x 5/16 PHL PNH ZNC PLT STL	7

Table 7-1. Parts List (Continued)

Item	Part Number	Description	QTY
842	303822	Screw, 3LOB, 4-20 x 7/16 PNH PHH ZNC-STL	3
843	300347	Screw, Machine, 4-40 x 5/8 PNH PHH	1
844	300928	Nut, Hex, 4-40 STL PL	1
845	300345	Screw, Machine, 4-40 x 1/4 PHL PNH ZNC PLT STL	4
846	305121	Screw, Machine, PNH	6
	10011281	Directions for Use, $EtCO_2$	1

① Not sold by Cardinal Health.

Figure 7-1. Housing Assembly

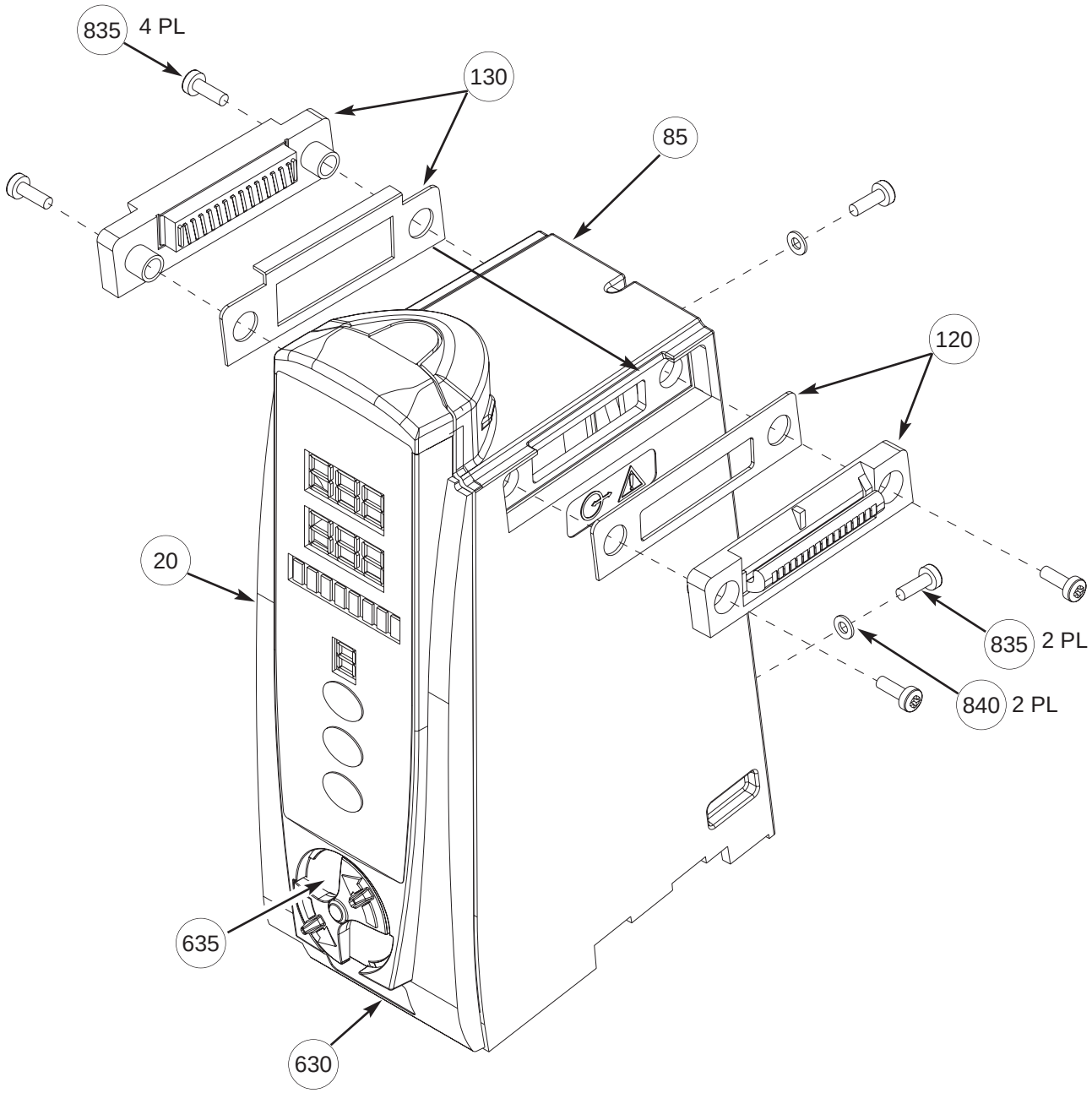


Figure 7-2. Frame/Front Case Assembly

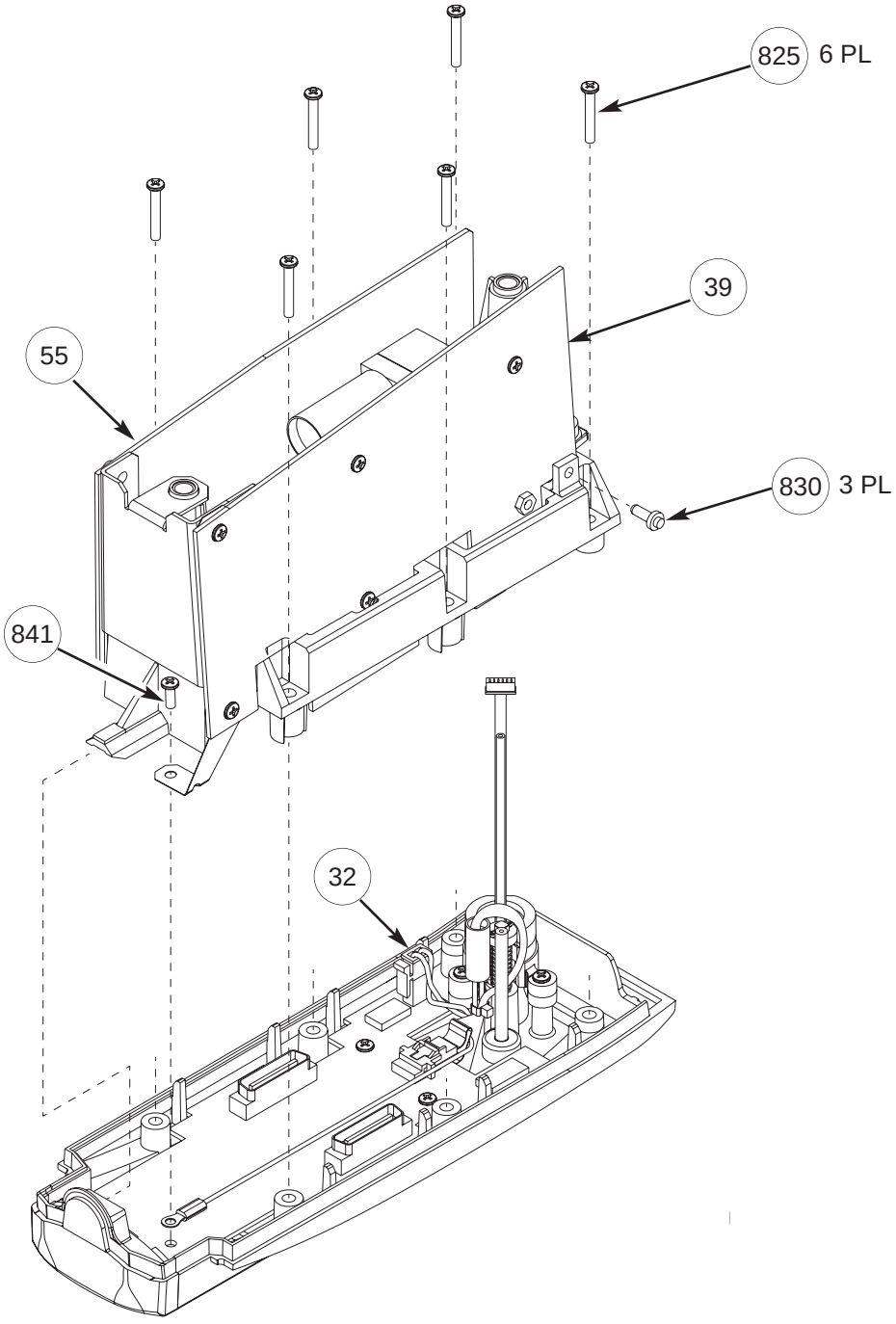


Figure 7-3. IUI Bracket/Frame Assembly

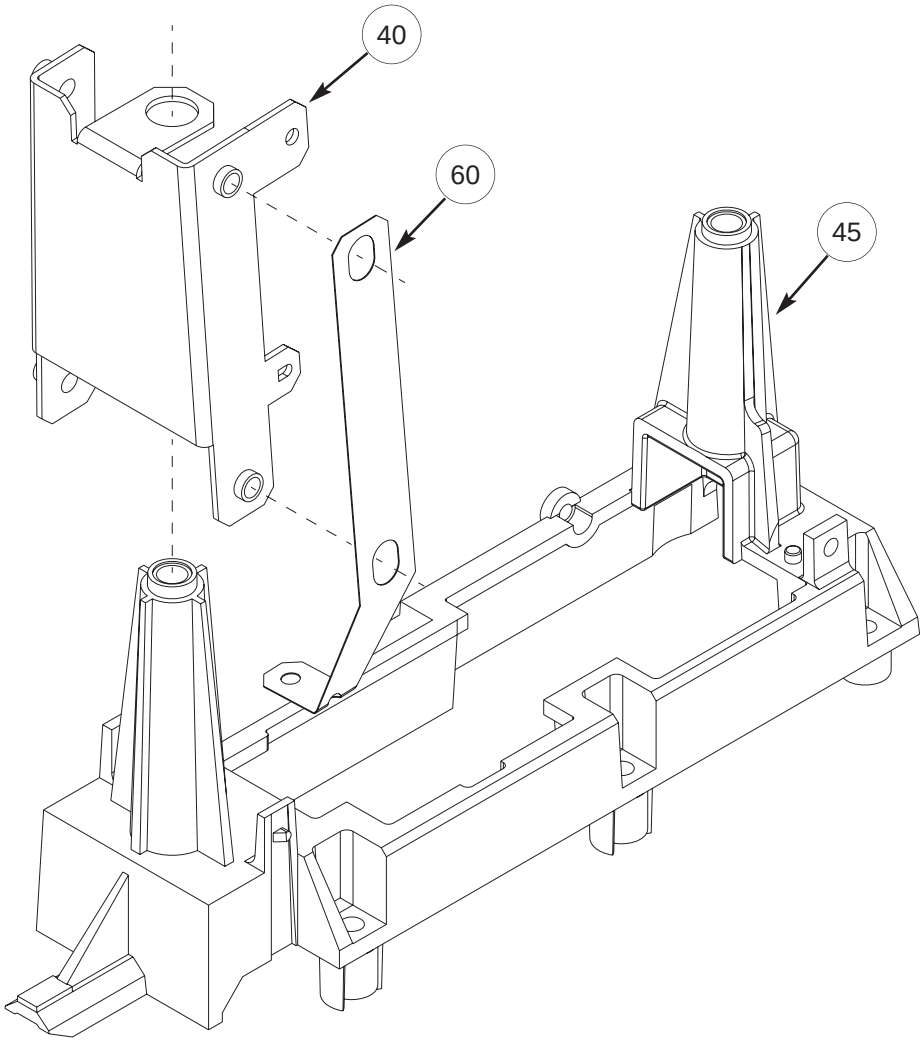


Figure 7-4. Oridion Module/Power Supply Board

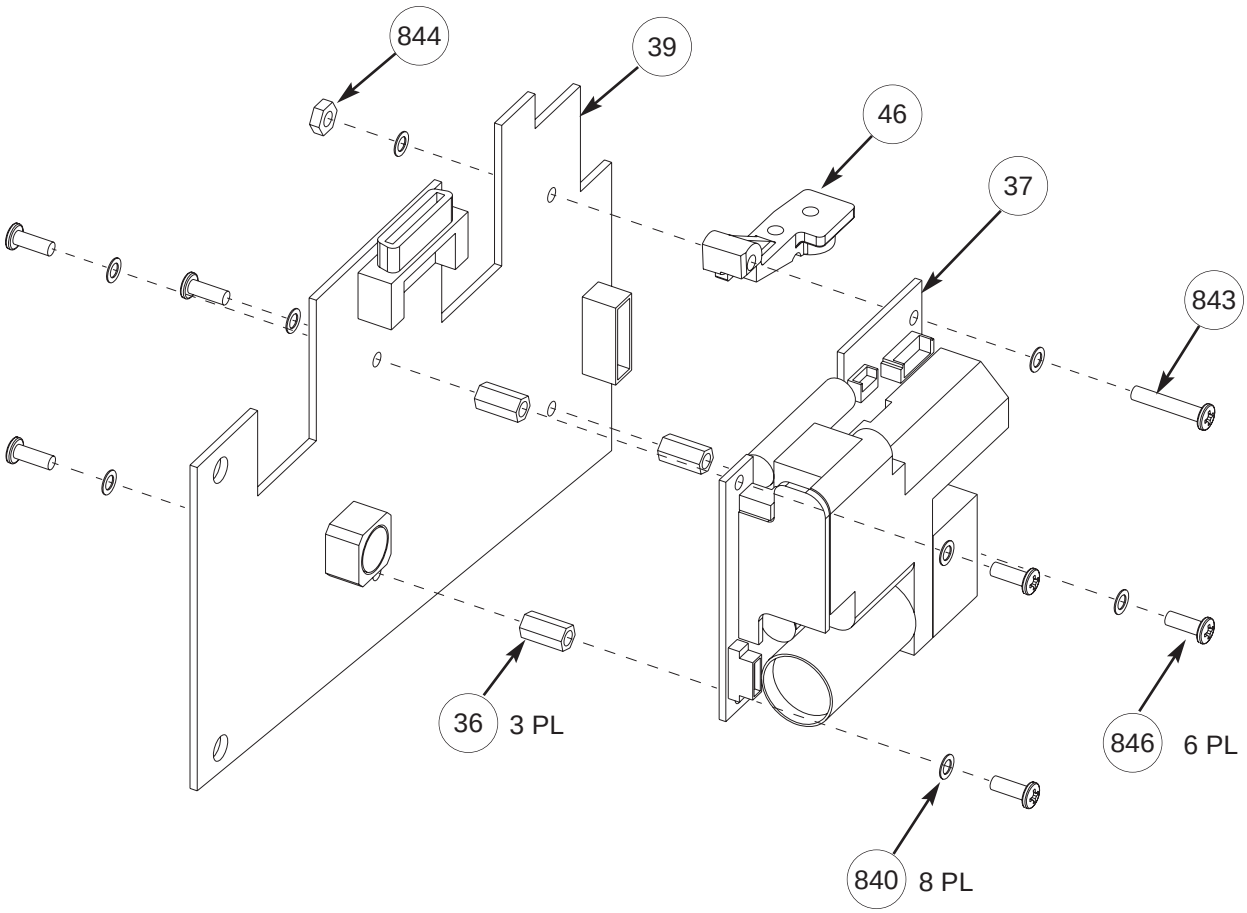


Figure 7-5. Front Case Assembly

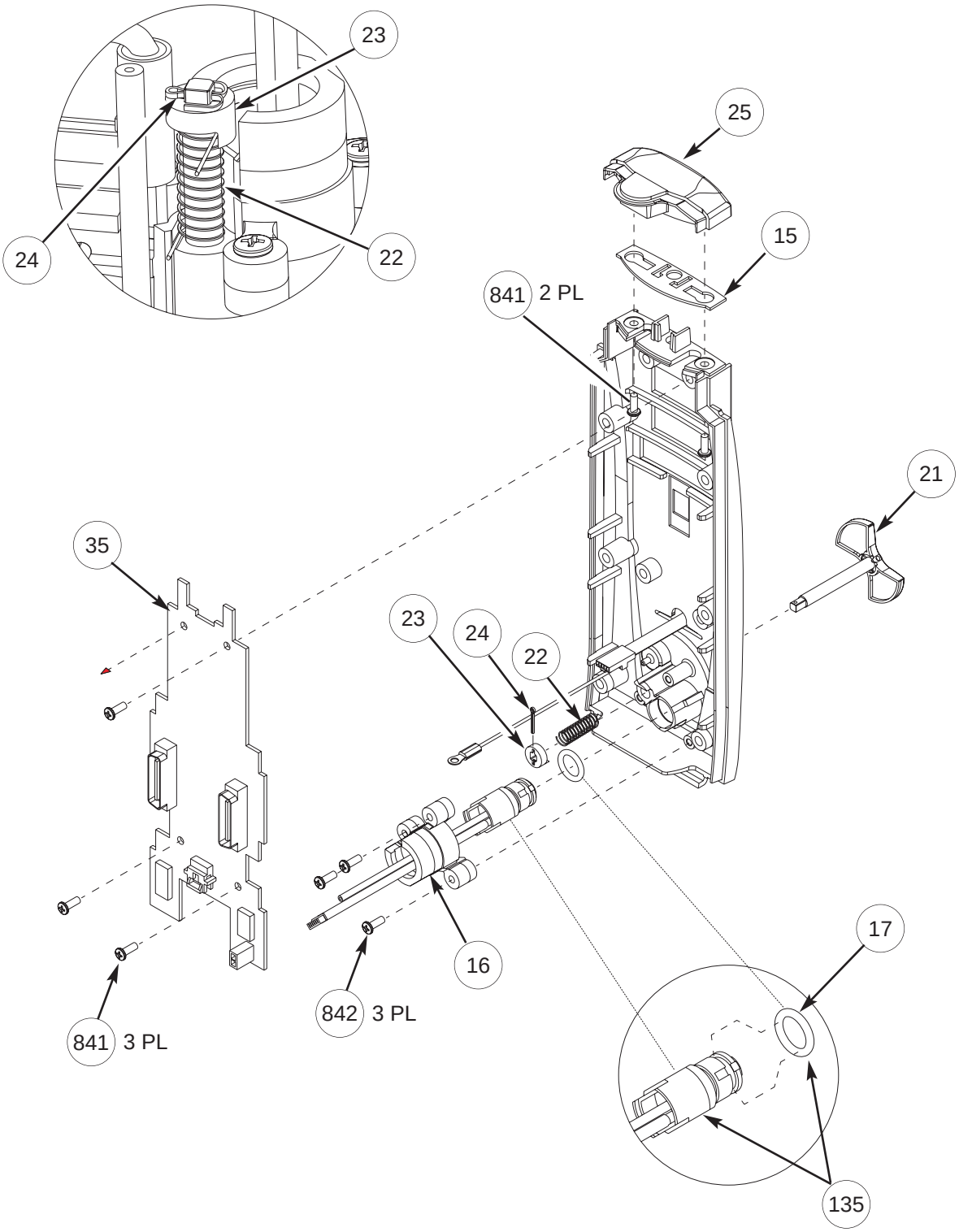


Figure 7-6. Rear Case Assembly/Latch Kit

1 Labels (items 603 and 620) are provided as separate items and as part of Rear Case Assembly Kit. Reference Table 7-1, item 85 for a list of parts included in Rear Case Assembly Kit.

2 Nameplate Label is available only as part of Rear Case Assembly Kit. This label has a regulatory mark, and any level of service that requires its replacement must be performed at the factory.

3 Before adhering Serial Number Label (item 603):
1. Print instrument model and serial number on label in permanent black ink.
2. Apply clear overlay to completely cover label.

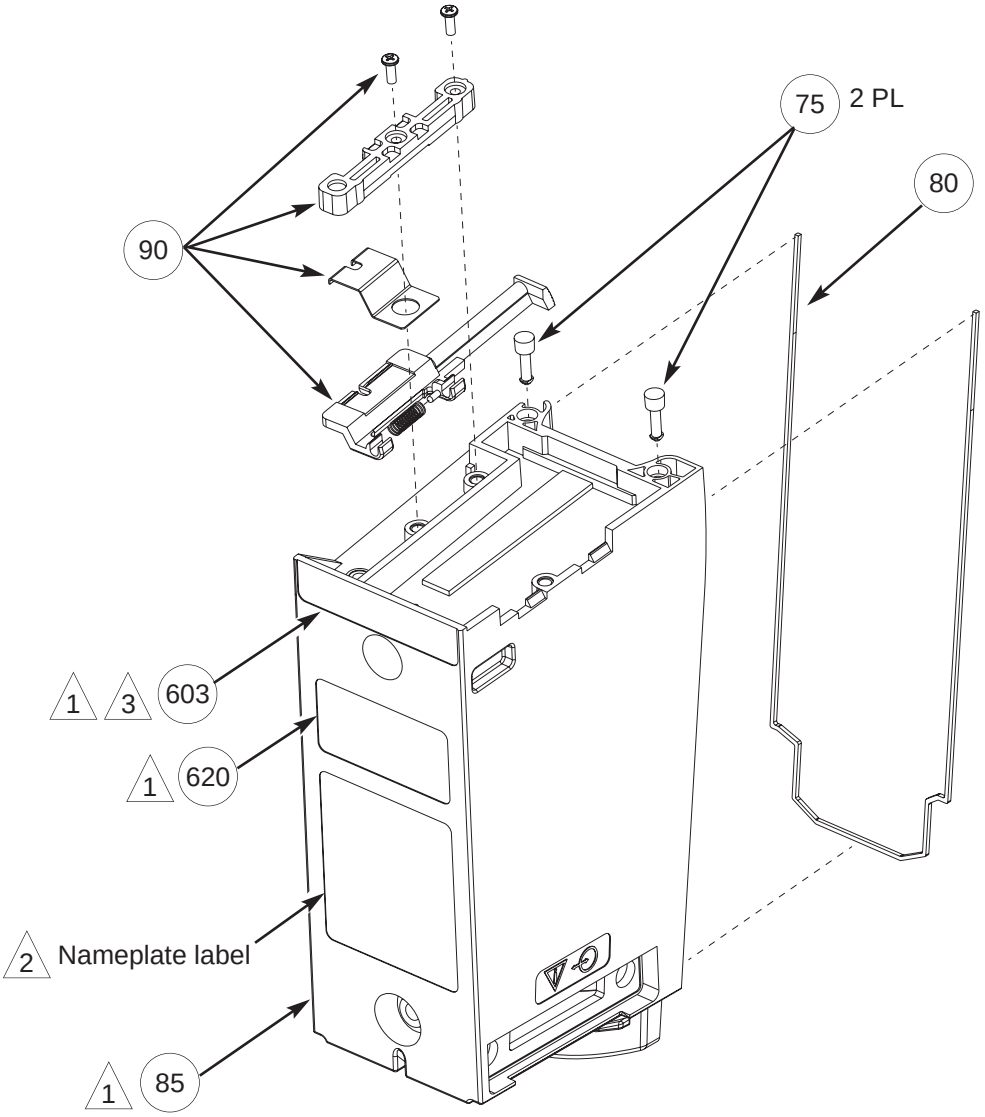
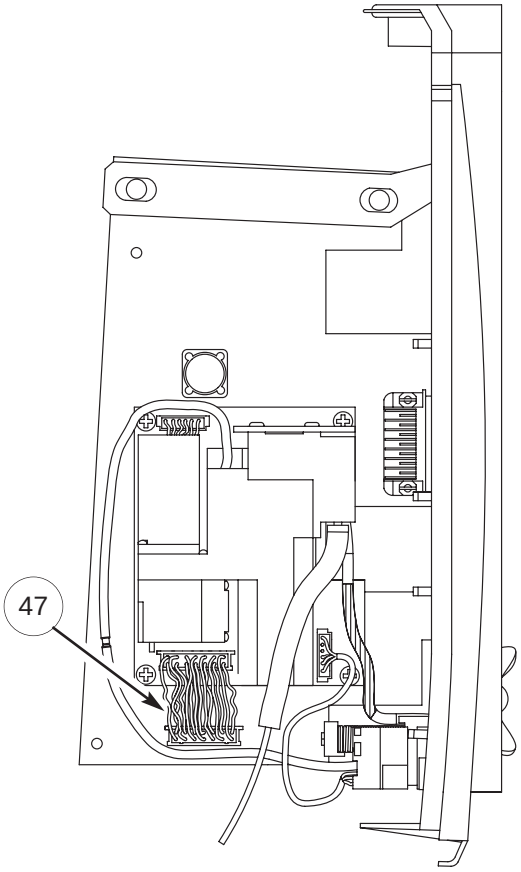


Figure 7-7. $EtCO_2$ Cable Assembly



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